Space Weather Technical Forecast

Issued on Sunday 20 October 2024 at 01:09 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Further M-flares likely, mainly day 1 (20 Oct). Chance of G1 Minor Storm intervals into the new week.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with three M-class flares, all from AR3854, peaking with an M6.5 at 19/0656 UTC. There are nine sunspot regions on the disc, with AR3852 no longer visible beyond the limb. The most notable activity currently from the leader portion of AR3854 which is now on the west limb and impossible to fully assess. Otherwise a slow declining trend is occurring across much of the disc. The main exception is AR3859, although this region remains generally stable. There are also two unnumbered regions, one very small spot developing in flux emergence in the northeast, and the other spot moving onto the southeast limb.

No Earth-directed CMEs were observed, with the CME associated with the above M6.5 flare expected to pass well ahead of Earth.

Solar Wind / Geomagnetic Activity: A weak enhancement in the solar wind was likely due to interactions with a CIR region on the southern edge of CH80/+. Solar winds speeds, as observed at L1 by ACE increased from near background to slightly elevated, 400 km/s to around 420-470km/s. Density was around or below average. The Interplanetary Magnetic Field (IMF), Bt, was moderate at first 10-12nT but eased to become generally weak 5-8nT. The north-south component, Bz, was turbulent and occasionally moderate, but favoured a negative (southward) orientation for much of the period. This ranged between -10 to +9 nT. Phi angle was generally positive (away from the Sun), but did show brief rotations to negative (towards the Sun). Geomagnetic activity was Unsettled to Active (Kp3-4), with one period of G1 Minor Storm (19/0000-0300UTC).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at background. High energy electron flux (greater than 2MeV) observed by GOES16 was at Background to Moderate levels. The associated 24-hour fluence was below the Active threshold. The 20/0000 UTC observation was 2.06e6 total pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is forecast with isolated M-class flares likely at times. These most likely on day 1 (20 Oct) from AR3854 as it recedes onto the far-side, and late in the period as returning active regions increasingly rotate onto the disk.

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Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs currently forecast. Geomagnetic activity is forecast to be mainly Quiet to Unsettled initially but with a chance of isolated Active to G1 Minor Storm intervals from any further enhancement from CH80/+ day 1 (20 Oct). Fast wind onset associated with CH82/+ is then expected to bring Active to G1 Minor Storm intervals, perhaps later on day 2 (21 Oct), but more likely on day 3 (22 Oct), before activity is expected to decline into day 4 (23 Oct).

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is expected to remain at background. High energy electron flux at GOES-16 is forecast to remain mainly Low with the associated 24 hour fluence expected to remain below Active (1e8 total pfu).

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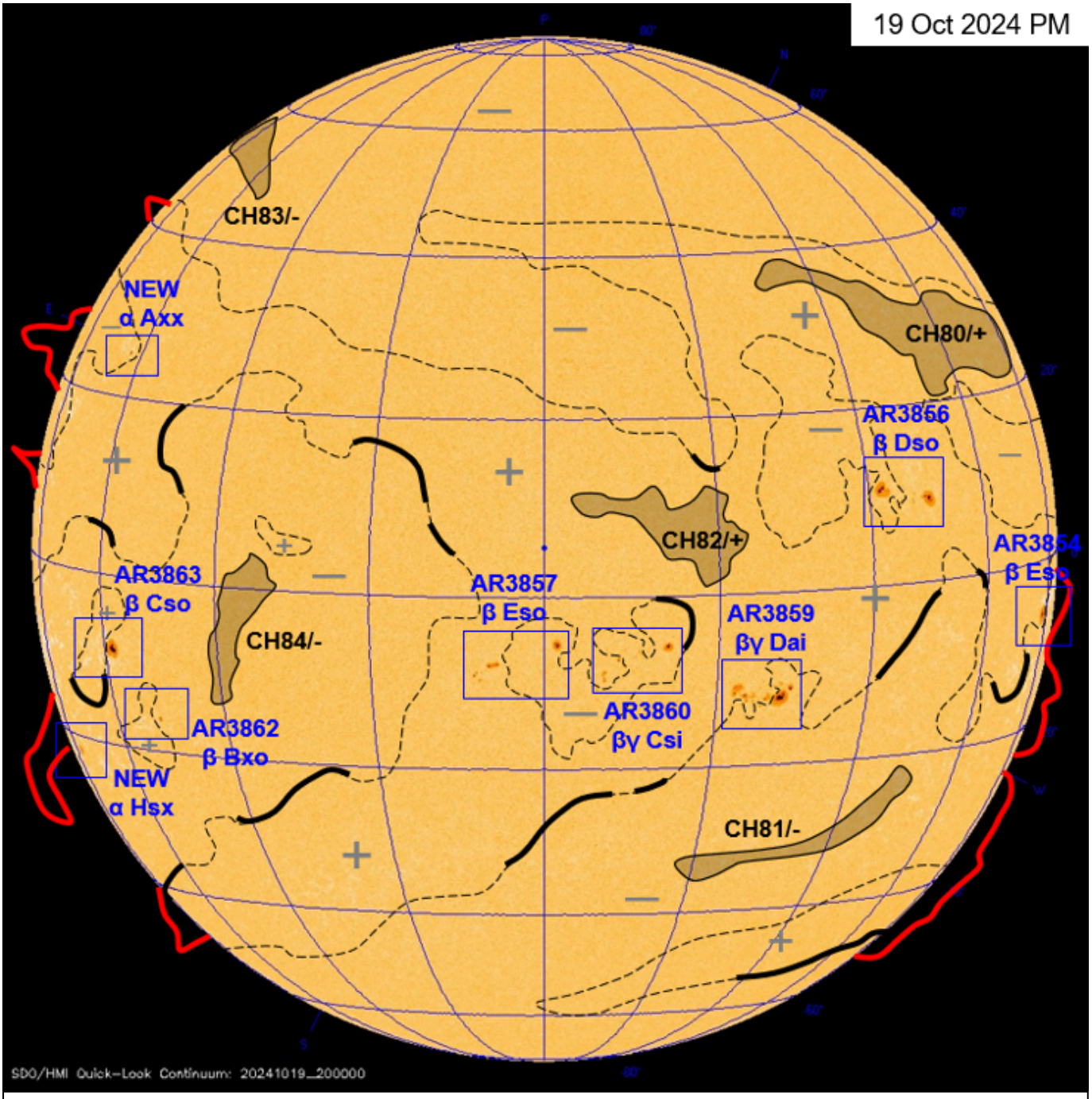
Figure 1: Solar Synoptic Map 19/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

There are no Earth-directed CMEs currently forecast.

Solar winds are currently slightly elevated , likely due to interaction with CH80/+, the large coronal hole in the northwest, and while the core of the fast wind is likely passing north of Earth, ongoing interactions with the southern edge of the winds are possible given Earth's current location north of the elliptic plane. This could give further spells of slightly elevated to elevated winds of around 450-500km/s during day 1 (20 Oct) before conditions are expected to generally decline into day 2 (21 Oct).

The next enhancement will then be from the likely onset of fast winds from CH82/+. This is a smaller feature, but due to its more equatorial location has a high chance of connection, with the likely arrival for any CIR region expected to occur either late on day 2 or more likely into day 3 (21-22 Oct). A period of elevated solar winds is then expected to follow, and given G1 Minor Storm intervals were observed on the previous rotation associated with this feature, similar can likely be expected on this occasion. MOSWOC ENLIL output does show a weak enhancement possibly from this feature, however this is later that currently anticipated given the coronal holes location and not considered as good guidance.

Geomagnetic activity is forecast to be mainly Quiet to Unsettled initially but with a chance of isolated Active to G1 Minor Storm intervals from any further enhancement from CH80/+ day 1 (20 Oct). Fast wind onset from CH82/+ is then expected to bring Active to G1 Minor Storm intervals, perhaps later on day 2 (21 Oct), but more likely on day 3 (22 Oct), before activity is expected to decline into day 4 (23 Oct).

Geomagnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	Yes	10	20	50	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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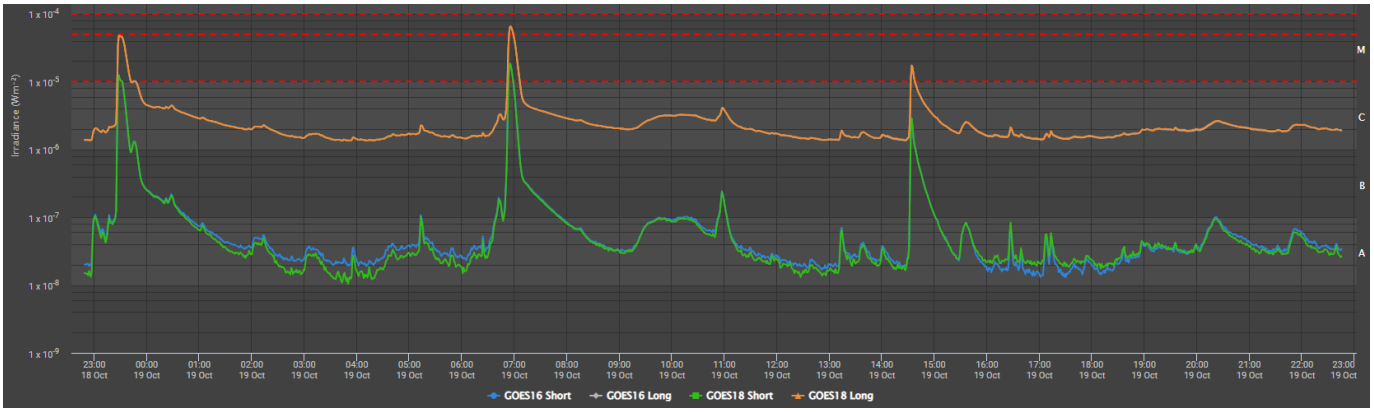
Radio Blackouts - X-Ray Flares

Solar activity is forecast to be Moderate at first with further M-class flares likely on day 1 (20 Oct), this is due to the ongoing activity from vicinity of the leading portion of AR3854. While this region is now over the west limb and impossible to assess, bright magnetic looping remains evident in SDO aia-imagery, and recent flares suggests an ongoing potential for further activity as this recedes onto the far-side early in the period. This includes the slight chance for an isolated X-class flare.

Into day 2 (21 Oct) activity is expected to become Low to Moderate, with the remaining regions currently on the disk appearing relatively small and magnetically simple, with little ongoing growth. The main exception to this is AR3859, although this region remains generally stable. A steady increase in activity looks likely into day 3 and 4 (22-23 Oct) however as recurrence and far-side sounding data suggest the return of several active regions.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	60	30	40	60
Very Active	R3-R5 (X Class)	No	10	5	5	10

Figure 2: Latest 24hr GOES16/18 X-Ray flare trace. All M-flares resulting from the AR3854 region.



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Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is expected to remain at background. There is a slight chance of enhancement on day 1 (20 Oct), due to the recent activity of AR3854 as it moves over the southwest limb, should any more significant flares occur. Otherwise, there is only a very slight chance of enhancement with limited flare activity from the other regions currently on the disc.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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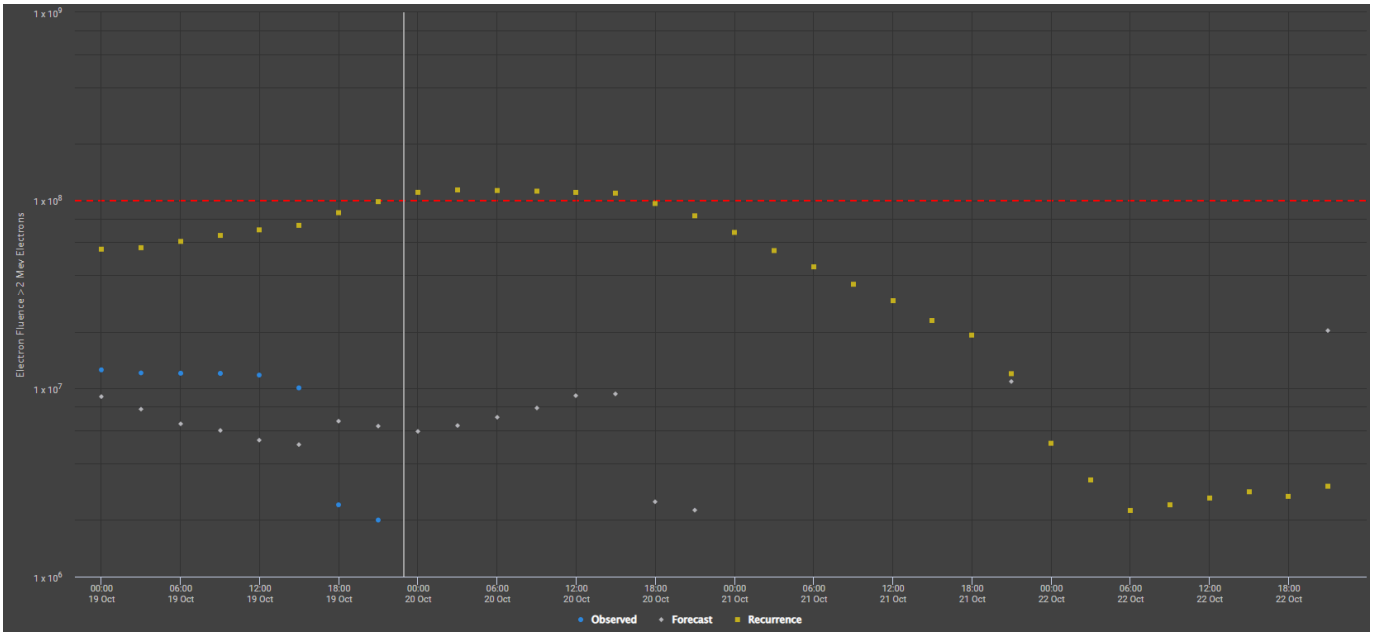
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES-16 have been Background to Moderate. These flux values are expected to continue, perhaps becoming more persistently background after the recent weak solar wind enhancement, or any further coronal hole fast wind interaction on day (20 Oct). Onset of fast winds from central disc CH82 is also likely to suppress values, but with a chance of rising to Moderate into day 4 (23 Oct).

The associated 24 hour fluence is expected to remain below Active with MOSWOC REFM thought to currently be providing generally good guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	5	10
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 3: Latest MOSWOC REFM output.



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